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ABSTRACT

First, second, and third grade students were asked to drew inferences after reading stories written by themselves, by peers, and by adults. The 70 subjects were divided into groups of slow-inaccurate, slow-accurate, and fast-accurate readers. After reading each type of story, they responded to six questions requiring text-based inferences. Analysis of both the number of correct responses and the number of erroneous inferences revealed significant decoding ability by story-source interactions. Fast-accurate readers showed similar inferential abilities across all stories, whereas slow-inaccurate readers showed significant story-source effects and slow-accurate readers showed an intermediate trend. All readers demonstrated equivalent inferential abilities for their own stories, but the less skilled readers showed increasing deficits in correct inference making for stories written by peers and adults. There were no significant differences for silent or oral reading conditions. (Author/FL)

INFERENTIAL COMPREHENSION: THE EFFECTS OF TEXT SOURCE, DECODING ABILITY, AND MODE

A paper presented at the Annual Convention of International Reading Association, Anaheim, CA., May 5, 1983.

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ABSTRACT

First, second, and third graders were asked to draw inferences after reading stories written by themselves, by peers, and by adults. Subjects were divided into groups of slow inaccurate readers; slow accurate readers; or fast accurate readers. After reading each type of story, subjects responded to six questions requiring text-based inferences. Analysis of both the number of correct responses and the number of erroneous inferences revealed significant decoding ability by story source interactions. Fast accurate readers showed similar inferential abilities across all stories, where slow inaccurate readers showed significant story source effects. Slow accurate readers showed an intermediate trend. All readers demonstrated equivalent inferential abilities for their own stories, but the less-skilled readers showed increasing deficits in correct inference making for stories written by peers and adults. There were no significant differences for silent or oral reading conditions.

INFERENTIAL COMPREHENSION: THE EFFECTS OF TEXT SOURCE, DECODING ABILITY, AND MODE

The present investigation focused on the intersection of comprehension theory with language-experience theory, using a framework of interactive variables. Current comprehension theory was summarized in the following statement issued by the National Intitute of Education:

> The Reading and Language Studies Division views reading as an interactive process (interpretive and perceptual processes influence each other); as a constructive process (previous knowledge in the content of the text one assembled to create meaning); as a strategic process (skilled readers have many strategies for attacking text in order to construct its meaning); and as a process that must be adjusted to the discourse structure of the text being used. (USDE, 1980, n. p.)

Of specific interest in the present study was one facet of comprehension: inference. In examining the NIE statement from a language-experience perspective, several problems presented themselves for investigation. Does the language-experience approach, in theory or practice, contribute to the development of inferential abilities in children? Do readers with more advanced perceptual skills display better interpretive skills (interaction)? Do readers construct meaning, connecting text and previous knowledge, more readily in

their own stories, in stories written by peers, or in stories written by adults (construction)? Is oral reading more facilitative than silent reading when the goal is inferential comprehension (strategy)? If the process of reading must be adjusted for text being read, in what ways do readers change that process in going from reading stories they have written themselves to the reading of classmates' stories, to the eventual wide reading required of the skilled reader?

Psychologists, psycholinguists, and educators have become increasingly sophisticated in examining comprehension theory and research as a foundation for a sound theory of reading instruction. Many have concluded that reading instruction should be based on both cognitive and linguistic continuity with the child's experiences and language. These writers often endorse a language-experience ideology, either explicitly or implicitly.

Hall called for an examination of the language-experience approach in relation to comprehension theory because "comprehension in terms other than those of achievement have gone unexamined in language-experience studies" (Hall, 1978, p. 40). She urged research analyzing both the products and processes of children's writing. Stauffer (1980) emphasized that both language and experience "play an enormously important role not only in the way reading ability develops into critical comprehension but also in the way logical thinking develops" (p. 18). Halliday (1973) warned that early reading difficulties may develop because children are taught to read from texts that violate what children have learned about language. A

language-experience approach was endorsed by Pearson (1976) to remedy such a violation by establishing the "natural tie between oral and written language" through the base of meaning present in children's store of syntactic and semantic relations" (p. 311).

In supporting a language-experience approach to reading, Piagetian Murray (1978) stated that "the match between cognitive structure and the task exists by definition" (p. 107). His concern was that the conceptual development of the child be consistent with the comprehension demands of the text. Psychologist Athey (Note 2) strongly endorsed the language-experience approach for the development of comprehension because "the language-experience approach is based on the postulate that reading is thinking at all levels of the cognitive hierarchy" (p. 19).

While no one has directly measured how well children comprehend stories they have written or stories written by peers, there is some evidence to support language-experience stories as reading text. Tatham (1970) recommended using children's language patterns as beginning texts. Children seemed to comprehend sentences based on probable past experiences better than impersonal and improbable sentences (Mood, 1979). Rhodes (1979) found comprehension to be higher in familiar, predictable stories with natural language.

Measure of comprehension in the previous studies did not include the unique (Davis, 1968) factor of inference. Inference is information based on the text but not explicitly stated, requiring the reader to interpret the text through existing knowledge. Writers have attempted

to define inference by creating intricate categorical systems, and in some cases hierarchies of inferences (Flood, Note 4). In the present study the nonhierarchical system developed by Warren, Nicholas, and Trabasso (1979) was adopted (see Table 1). Some modification was necessary; for example, categories of elaboration and evaluation were excluded because inferences in these categories are often not text based (Warren et al., 1979). In addition to their taxonomy of inference, the relevancy hypothesis suggested by Warren et al. (1979) was adopted as stated:

> In understanding a narrative a listener [or reader] makes only those inferences relevant to the progress of the narrative. . . . Relevant inferences establish the information necessary to determine what happened and why. (p. 44)

Insert Table 1 about here

In addition to establishing a working definition of inference, researchers must examine or account for factors known to influence inferential comprehension. Pearson, Hansen, and Gordon (1979) found that prior knowledge had a facilitating effect, a finding consonant with the earlier definition of inference as a process drawing on existing knowledge. The influence of text structure has been supported by Mandler and Johnson (1977). With the hypothesis that importance, salience, and explicitness would affect comprehension, Goetz (1977) found that inferences were more likely to be made when they were important to the story (which supports the relevancy hopothesis);

Table 1

Taxonomy of Inferences During Story Comprehension

Classes		Functions
1.	Logical inferences	
	a. Motivation	Inferring causes for a character's given voluntary thoughts, actions, or goals (or vice versa), e.g., Carol was angry. She decided to get even.
	b. Psychological cause	Inferring causes for a character's given involuntary thoughts, actions, or feelings (or vice versa), e.g., John tripped on the stone. He shouted.
	c. Physical cause	Inferring mechanical causes for given objective events or states (or vice versa), e.g., Lightning struck the tree. The tree burned all night.
	d. Enablement	Determining the conditions necessary but not sufficient for a given event to occur. Determining the event a certain condition allows, e.g., It was windy. They could fly the kite.
2.	Informational inferences	
	a. Pronominal	Specifying the antecedents or pronouns, e.g., Chuck was late for Mark's party. He said he was sorry.
	b. Referential	Specifying the related antecedents of given actions or events when the reference is not pronominally marked, whether or not they are explicitly stated in other propositions, e.g., Sara found her father's car in front of the school and hopped in.
	c. Spatio-temporal	Determining the place or time of a single or series of propositions, e.g., It was Friday afternoon and the children were taking a spelling test.
	d. World-frame	Determining a world context to account for inferences, e.g., They saw the lions, tigers, seals, and monkeys.

Note. Based on "Event Chains and Inferences in Understanding Narratives," by W. Warren, D. Nicholas, and T. Trabasso, in Freedle (Ed.), New Directions in Discourse Processing, 1979, pp. 23-52.

salience was reported to enhance the inferring of students with low verbal ability. The eliciting (or retrieval) of inference was shown to be higher using probed questions than relying on free recall (Tierney, Bridge, & Cera, 1979-1979). Paris has demonstrated that even young children, who did not produce inferences spontaneously, could do so when prompted through dramatic interpretation of implicit material (Paris & Lindauer, 1976).

The ability to draw necessary and appropriate inferences tends to increase with age (Mandler & Johnson, 1977; Stein & Glenn, Note 7; Tatham, 1970). However, researchers are beginning to question the validity of treating an age or grade as a homogeneous group. There is an emerging perception of need for skill-level research (Chall, 1979; Schadler & Thissen, 1981). Some attempts to establish skill-level groups have been based on oral reading rates (Biemiller, 1977-1978) and standardized reading tests (Schadler & Thissen, 1981). In the present study, categories suggested by Perfetti and Lesgold (1979) were found to be useful. They proposed three decoding levels: "inaccurate performance, slow accurate performance, and automated performance" (p. 78). Rate and accuracy criteria were applied to establish groups of slow inaccurate, slow accurate, and fast accurate readers.

A final factor of reading under investigation was how a reader's strategy affects comprehension, specifically inferential comprehension. One strategy decision readers must make (or have made for them) is whether to read a passage silently or orally. Many reading theorists support early and predominant emphasis on silent reading (Gibson &

Levin, 1976; Goodman, 1973; Smith, 1978). However, there is little clear research support for their position. Rowell (1976) found that third and fifth graders obtained higher comprehension scores orally than silently. Average and below-average readers comprehended as well or better reading orally compared with silently (Swalm, 1972). The effects of mode on inferential comprehension have not been examined. However, it is an interesting question. Since inference involves the "extra" processing step of drawing on previous knowledge, is processing aided or hindered by auditory input? Do poor decoders, who are encouraged to read aloud most often at school, infer better reading orally? Conversely, do skilled decoders infer better in their encouraged mode, silent reading?

Several questions are raised by reviewing theory and research on inferential comprehension and language-experience reading instruction. First, do primary-grade children infer well on their own stories, as one would expect? Are they more likely to draw correct inferences on peer stories, where the language and experiences may be familiar, than on adult stories? Second, is there a connection between decoding ability and inferential ability, in addition to the documented increase in appropriate inferences made with age? Third, do primary-grade children make more correct inferences when they read silently or orally? And finally, perhaps most important, do the factors of text source, decoding ability, and reception mode interact, presenting teachers with a picture of who should be reading what, when, and how?

Method

Subjects

Primary (first, second, and third) grade students from four elementary schools in a Midwestern university town were tested for decoding proficiency. Seventy subjects were classified into three groups of 23 or 24 on the basis of their oral reading rates and word-recognition scores on the first-grade passage of the Basic Reading Inventory (Johns, 1981). Teacher estimation of ability was solicited as an additional measure of reliability. Ability groups consisted of fast ($\bar{x}$ wpm = 144) accurate ($\bar{x}$ WR = 99.4) readers, slow ($\bar{x}$ wpm = 72) accurate ($\bar{x}$ WR = 93.7) readers, and slow ($\bar{x}$ wpm = 24) inaccurate ($\bar{x}$ WR = 72.2%) readers. Within each group, students were assigned randomly to oral or silent reading conditions.

Materials

All subjects were tested on three passages: a story previously dictated by the child being tested, a story previously dictated by a classmate, and a story written by an adult writing for school-children. Dictated stories were used after a preliminary study indicated that many young children could not write down a story of sufficient length to assure possible test questions. The child-written passages were obtained by having each subject dictate a story to the examiner, given instructions to "tell me a story about something interesting that has happened to you." Each story was typed and presented to the author several days later as a test passage. The peer-written story was chosen through random drawing from the pool of stories written by the child's

classmates. Four stories from the Reader's Digest Skill Builder (Berke, 1977) series were used as the adult-written passages. These stories, rotated within each group, were selected because they were not available to the children in their schools, they were written at a first-grade reading level, and stories were an appropriate length (100-150) words). Child-written stories averaged 111 words.

Procedure

Each subject was tested individually in a private setting, with sessions lasting from 15 to 30 minutes. Stories were presented in rotated order (e.g., adult, peer, self) within groups. After reading each story, subjects were instructed to "Tell me everything you remember about the story you just read. After oral retelling, students were asked to answer six inference questions. Probes were written using the Warren et al. (1979) criteria for text-based, relevant inferences. Questions were presented and answered orally. Table 2 presents a sample story and examples of inference questions that could be asked in each category.

Insert Table 2 about here

Scoring procedure. Free and probed recalls were transcribed verbatim. Three judges were trained to identify text-based relevant inferences. Interrated reliability for scoring probed and free recalls on ten passages was .86. The remaining passages were divided equally among the three judges, who identified all correct, text-based inferences and all incorrect inferences. Nonanswers (shrugs, "I-don't-knows") and literal recalls were not analyzed.

Table 2

Sample Story and Inference Probes

Paul, Amy, Kate, Luke, and Jay went to Mark's birthday party. He was eight years old. They walked to the pond to go swimming. As soon as they got there, they jumped in. Soon dark storm clouds filled the sky. The children were worried. Mark started to cry. The children ran past the barn to Mark's house. They were too late! "Don't feel bad," said Mark's friend Amy. "This was a fun birthday party. We got to get wet twice."

	Category	
1.	motivation	Why did Mark cry? (He was disappointed that his party was ruined.)
2.	psychological cause	Why were the children worried? (They knew it was about to rain.)
3.	physical cause	How did the children get wet? (First by swimming, then from the rain.)
4.	enablement	What happened as a result of the dark storm clouds? (It rained.)
5.	pronominal	Who was eight years old? (Mark)
6.	referential	What did the children jump in? (The water, the pond)
7.	spatio-temporal	What time of year was it? (Summer)
8.	world-frame	Where does Mark live? (In the country, on a farm)

Design and Analysis

A 3 x 3 x 2 factorial design with repeated measures on one variable was used. The independent variables were decoding ability (fast accuarte, slow accurate, slow inaccurate), text source (three levels repeated: self, peer, adult), and reading mode (silent, oral). Variables were analyzed under four conditions: correct inferences. probed recall; incorrect inferences, probed recall; correct inferences, free recall; incorrect inferences. free recall.

Results

When correct inferences elicited through probed recall were analyzed, significant main effects were found for decoding ability, $F\ (2,64) = 23.97$, $p < .01$, and for text source, $F\ (2,128) = 59.24$, $p < .01$; no difference was found for mode. Means and standard deviations are reported in Table 3. There was also a significant interaction between decoding ability and text source, $F\ (4,128) = 7.18$, $p < .01$. The Tukey test for Honest Significant Difference comparing weighted means computed at the .05 level of significance, revealed no significant differences for decoding ability on self stories (slow inaccurate $\bar{x} = 5.52$, slow accurate $\bar{x} = 5.50$, fast accurate $\bar{x} = 5.70$). On peer stories, slow inaccurate readers made significantly fewer correct inferences ($\bar{x} = 2.91$) than either slow accurate ($\bar{x} = 4.25$) or fast accurate ($\bar{x} = 4.74$) readers. On adult stories, slow inaccurate readers made significantly fewer correct inferences ($\bar{x} = 1.95$) than either slow accurate ($\bar{x} = 3.54$) or fast accurate readers ($\bar{x} = 4.74$). In addition,

slow accurate readers made significantly fewer correct inferences ($\bar{x}$ = 3.54) than fast accurate readers ($\bar{x}$ = 4.74).

Insert Table 3 about here

The Tukey test also revealed that slow inaccurate readers made significantly fewer correct inferences on both peer ($\bar{x}$ = 2.91) and adult stories ($\bar{x}$ = 1.95) than on self stories ($\bar{x}$ = 5.50). Fast accurate readers performed equally well across text sources.

Figure 1 presents a graph of the interactions between text source and decoding ability. To summarize the findings, all ability groups performed quite well on their own stories, but less automatic decoders showed increaseing deficits in making correct inferences on peer and adult stories. The skilled decoders demonstrated uniform inferential ability on all texts; slower, less accurate decoders showed significant story source effects.

Insert Figure 1 about here

The ANOVA for incorrect inferences, probed recall yielded similar, though not identical, results to the correct probed recall ANOVA. These comparisons are not minor images; in addition to correct or incorrect inferences, children responded with factual statements and nonanswers. Again, there was a significant interaction between decoding ability and text source, $F(4,134) = 4.58$, p .01. The Tukey test revealed similar results to the analysis of correct probed recalls, with one exception. Slow inaccurate readers made significantly more incorrect inferences on

Table 3

Descriptive Statistics, Correct Probed Inferences

Source	Reading ability group: Slow inaccurate (n = 23) Mode: Oral (n = 12)	Slow inaccurate (n = 23) Mode: Silent (n = 11)	Slow inaccurate (n = 23) Group Mean	Slow accurate (n = 24) Mode: Oral (n = 12)	Slow accurate (n = 24) Mode: Silent (n = 12)	Slow accurate (n = 24) Group Mean	Fast accurate (n = 23) Mode: Oral (n = 11)	Fast accurate (n = 23) Mode: Silent (n = 12)	Fast accurate (n = 23) Group Mean	Grand Mean
Self										
$\bar{x}$	5.58[a]	5.45	5.52	5.67	5.33	5.50	5.64	5.75	5.70	5.57
SD	.67	.93	-	.49	1.07	-	.81	.45	-	
Peer										
$\bar{x}$	2.83	3.00	2.91	4.00	4.50	4.25	4.45	5.00	4.74	3.97
SD	1.75	2.00	-	1.71	1.31	-	.93	.85	-	
Adult										
$\bar{x}$	2.33	1.54	1.95	3.92	3.17	3.54	4.82	4.67	4.74	3.41
SD	1.44	1.21	-	1.68	1.80	-	1.17	1.07	-	
Total										
$\bar{x}$	3.58	3.33	3.46	4.53	4.33	4.43	4.97	5.14	5.06	4.32

[a]Six questions were asked after each story.

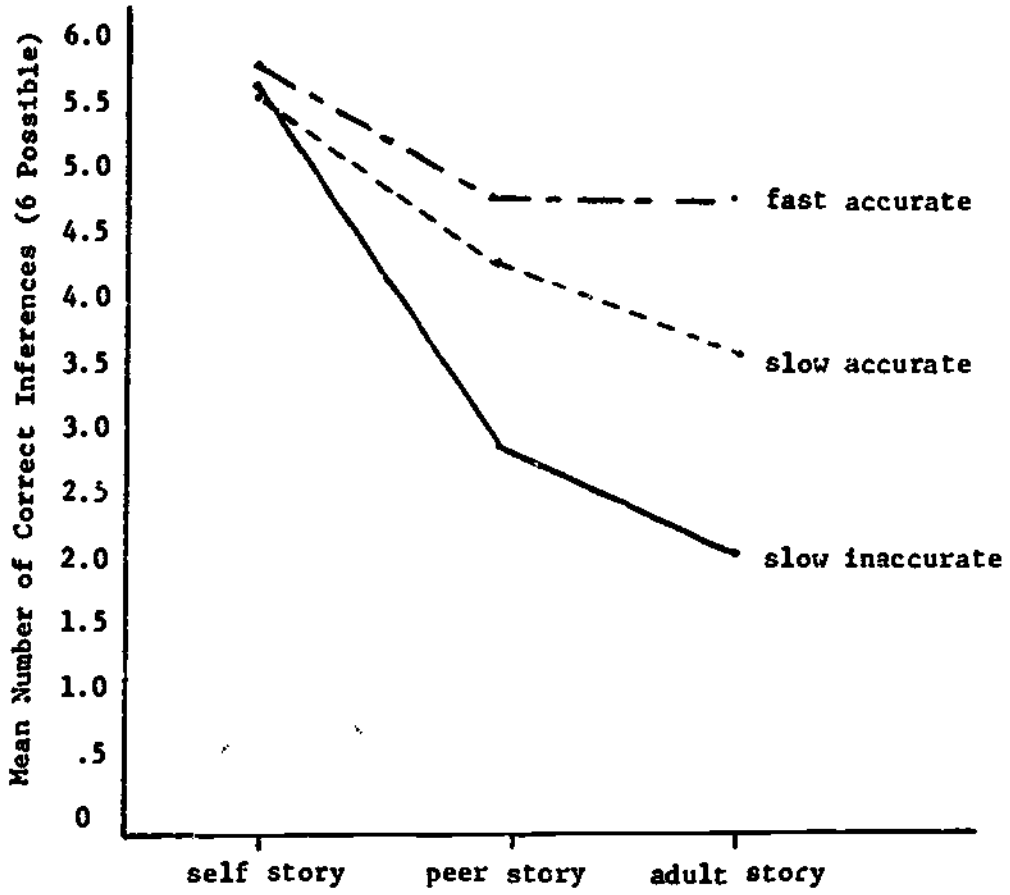

Figure 1. Interaction of source and ability for correct inferences, probed recall condition

peer stories ($\bar{x}$ = 1.00) than on self stories ($\bar{x}$ = .04), and significantly more incorrect inferences on adult stories ($\bar{x}$ = 1.74) than on peer stories. Thus, the three text sources differentiated three levels of inferential ability for unskilled decoders.

The ANOVAs of free recalls, both correct and incorrect, added little information. Children made very few inferences, correct (grand $\bar{x}$ = .51) or incorrect (grand $\bar{x}$ = .41), during the free retelling of stories from any source. However, significantly more incorrect inferences were made on peer stories ($\bar{x}$ = .27) than on self stories ($\bar{x}$ = 0.00)[1], and on adult stories ($\bar{x}$ = .54) than either peer or self. Slow inaccurate readers made significantly more incorrect inferences ($\bar{x}$ = .67) than fast accurate readers ($\bar{x}$ = .17)

Discussion

At the outset of the investigation, several questions were asked based on theoretical assertions and empirical findings. The data support much current thinking, if not practice; surpriaingly, they also contradict some current thinking and practice.

The first variable examined was text source, using child-written (self and peer) and adult-written texts. Why were children able to answer inferential questions correctly more often on their own stories than on stories from other sources? An obvious answer might be that inferential processing was not required: children simply "remembered" the answers. However, referring to the definition of inferring, children were able to offer information not stated in the text.

Enabling them were excellent prior knowledge (Hansen, 1981) and complete story schemas. The fact that the process was easy for them does not negate it as an inferential operation.

Is there any meaningful difference between an "easy" inference and memory of an event? Does a complete story schema preclude inferential thinking? If children had been asked to monitor their thinking, would they have been able to separate memories from inferences? The researcher concluded, from observation and question/answer analysis, that children reading their own stories were operating on a continuum of information processing from memory to inference. There was an interaction of text, reader's memory, and probing question. As Raphael and Pearson (1982) pointed out, it is not helpful to classify questions in isolation (e.g., fact, inference); teachers must "identify a question type according to its relationship to both the text and the knowledge base of the reader" (p. 10). Many "inference" questions asked on self-stories called for reader-based processing; some lay on the continuum towards text-based processing (Singer & Donlan, 1982; Tierney & Spiro, 1979).

The educational implication is that teachers should use self-written stories in the primary classrooms. On the most simple level, such stories provide a vehicle for "catching" inferential comprehension (Veatch, Sawicki, Elliott, Barnette, & Blakey, 1973). Asking inferential questions on self-stories also provides children with high initial success, well above the 80 percent suggested by Cunningham (Note 3) for effective comprehension activities. A third potential for self-stories

and inference questioning is the opportunity for developing metacognition of inferential processing (Paris, Note 6).

A second question for consideration concerns peer stories. Should teachers encourage children to read stories of classmates? The data suggest a cautious yes; cautious because teachers should be aware that there may not be much difference (or that the differences may cancel each other) between peer and adult stories. One advantage of using peer atories for instruction is that children made fcwer incorrect inferences on peer stories than adult stories. A second factor favoring peer stories is high motivation to read them, a factor strongly supported by Anderson (Note 1). The writer feels that peer stories deserve further research consideration. An instructional sequence worthy of investigation would have children experience and monitor success with inferential comprehension of their own stories; move on to discussions of peer stories, with the authors present for unique text-author-reader interaction; and finally apply knowlege of inferential processing to adult-written materials.

A second question prompted an examination of skill-level comparisons rather than the traditional age-level or grade-level study. The data strongly support a correlation between decoding ability and inferential ability. For all comparisons where there was a difference, faster and more accurate decoders gave more correct inferences and fewer incorrect inferences. The data may be useful to teachers in understanding, if not instructing,

not-yet-proficient decoders. Slow inaccurate decoders were not able to answer inference probes on unfamiliar material, a finding that tends to support some level of automaticity for comprehension. More research is needed for determining factors contributing to automaticity (speed, accuracy, passage difficulty) and their weight. However, the present study indicates that children reading at 115 words a minute or faster with at least 98 percent word recognition are capable of drawing inferences with great accuracy.

Third, the issue of silent versus oral reading was investigated in relationship to inferential comprehension. A surprising finding from the study was that there was no significant difference in inferential comprehension for silent or oral reading for any ability group. The finding supports neither the theoretical stance of those who think silent reading is superior for comprehension (Gibson & Levin, 1976; Smith, 1978), nor the empirical conclusions of those claiming oral reading superiority (Rowell, 1976; Swalm, 1972). One explanation for finding no differences is that these young readers may not read at very different rates for oral and silent reading since that differentiation often takes place in third or fourth grade (Zintz, 1980). It is also possible that, when there was increased time for oral reading, it was necessary for pronunciation rather than comprehension, a conclusion reached by Juel and Holmes (1981). The implication for teachers in the primary grades is that efficiency of one mode over the other may be more an individual diffetence rather than a group norm.

The final question for consideration addressed potential interactions among text sources, decoding abilities, and reception modes. As discussed earlier, mode did not influence inferring to any significant degree. However, there was a strong interaction between text sources (self, peer, adult) and decoding ability (slow inaccurate, slow accurate, fast accurate). Interpretation of the interaction may be helpful in resolving the decoding/meaning dilemma of beginning reading instruction.

As Weaver (1980) pointed out, teachers must encourage early decoding proficiency because "comprehension suffers in relation to the degree of word recognition difficulty" (p. 17). However, many code-emphasis programs, "may discourage [children] from reading at all" (p. 58); they certainly do not encourage children to think, to interact with the text. Stories children write themselves offer an excellent solution to the decoding/meaning dilemma.

A language-experience approach to beginning reading instruction has been shown to be as effective in developing decoding skills as other methods (Bond & Dykstra, 1967). At the same time teachers are emphasizing automaticity, they can "catch" inferential comprehension, ask thought-provoking questions, and instruct children in the monitoring of their inferential strategies.

The argument for early instruction through child-written stories is supported by the data for slow inaccurate and slow accurate readers; fast accurate readers in the present study had already developed both decoding and inferential skills on all text

sources. Teachers who are aware of both speed and accuracy scores of primary students should be encouraged to construct a variable reading curriculum so that less proficient decoders can benefit from the intrinsic motivation of self-written stories and proficient decoders can advance to the wider world of adult-written materials.

In summary, the present study yielded valuable information about the inferential capabilities of first-, second-, and third-grade children with various degrees of decoding proficiency. Child-written stories hold promise for making children owners of texts rather than tenants of texts, as Harste (Note 5) argued they should be. An approach to reading that builds on the child's own language and unique prior knowledge, a language-experience approach to reading, should now be explored as an avenue not only to decoding proficiency but also to inferential comprehension.

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Footnotes

This article is based on the author's doctoral dissertation completed at the University of Kansas under the direction of Nita W. Sundbye.

[1]Since children made no incorrect inferences on their own stories, the argument can be made that a significant difference exists between self-stories and both other sources although no statistical analysis was possible.